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Swineford - Menominee Iron Range - 1880

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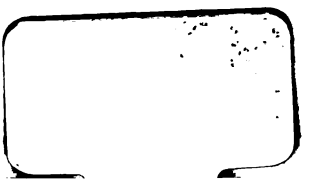

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Francis L. Patts
3905 Spruce St.
West Philadelphia
Pennsylvania

THE

Menominee Iron Range.

HISTORY

OF ITS MINES—WHEN AND BY WHOM DISCOVERED—THEIR

PRESENT CONDITION AND FUTURE PROSPECTS.

A. P. SWINEFORD.

THE MINING JOURNAL,
Marquette, Michigan, June, 1880.

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In view of the fact that the writer has been charged, unjustly it is true, with being, if not an enemy, at least unfriendly to the Menominee Range, he approaches the task now before him if not in fear and trembling, certainly with the knowledge that whatever he may say will be apt to subject him to severe criticism, should his opinions not fully accord with the views of mine owners and managers in that particular district, or with those of the tyros in mining affairs who are always the first to criticise and condemn that which, by reason of their own ignorance, they are unable to comprehend. He undertakes the task, however, at the suggestion of a number of his patrons who are interested in the development of the new range, and he enters upon the work with a determination to present as complete and accurate a history as may be possible, of the first discovery, subsequnt development and present condition of a region which, within a period of three or four years, has grown into an importance second only to the much older and more extensively developed iron fields of Marquette county. It may be that in the progress of this review he will have occasion to criticise the plan of operations at some of the mines; should such be the case, he asks in advance that he may not be credited with any other motive than a sincere desire to benefit rather than injure the interest under consideration, giving his suggestions for whatever they may be worth, and not as opinions which he considers infallible. In the gathering of information he may meet with unexpected difficulties, and possibly be led into error; in such case he can only say that he will be more than thankful to those who will kindly point out to him any errors of omission or commission they may be able to discover in what follows. It is his desire to treat the subject in hand fairly—to tell the story just as it is, dealing neither in fulsome praise on the one hand, nor unjust or captious criticism on the other.

When or by whom the first discovery of ore was made on the Menominee range is not positively known to the writer, whose attention was first called to the existence of ore in what must hereafter be known as the south belt of the district, by S. P. Saxton, in February, 1867. The specimens then shown were from what is now known as the Breen mine, which is in Section 22, Town 39, Range 28, and which had been discovered the summer or winter previous by Thomas and Bartley Breen. The specimens were not such as to commend the new district to the favorable attention of capitalists seeking investments of the kind, taking into further consideration the fact that the newly discovered deposit was then far remote from any line of railway. The late Judge Ingalls, together with the Breen brothers and Mr. Saxton, were strong in the faith, however, that they had discovered the nucleus of what was destined

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sooner or later to become one of the most important iron mining districts in the country; and, though possessed of little capital, they held on to their proprietary interests in the region, and patiently awaited the development which they felt certain must come in the near future. It is probable that the existence of iron ore on the range in question was known before the discovery made by the Breen brothers, but to them belongs the honor of having first brought the range into such prominent notice as to lead to the subsequent examinations through which the large extent and excellent quality of its ore deposits were finally established. The late Judge Ingalls was, from the start, an enthusiastic believer in the great mineral wealth of the region, and never tired in his efforts to secure its early development. The writer well remembers having introduced in the legislature of 1871 a bill prepared and forwarded to him by Judge Ingalls, giving a grant of state swamp lands to aid in the construction of a railway from the mouth of Deer Creek to the newly discovered ore deposits in Town 39, Range 28. The bill was backed by a numerously signed petition, but many of the petitioners being unable to write their names, there was a sameness about the signatures which struck the committee to whom the bill had been referred unfavorably, notwitstanding the matter was fully explained to them, and they reported adversely, being further prompted to such action by an equally strong remonstrance signed by prominent citizens of Menominee, who then hoped that their village might ultimately be made the shiping point for whatever mines might be developed on the new range. The matter is only referred to here for the purpose of showing the zeal which Judge Ingalls evinced in his efforts to bring about at an early day the results which have since then been attained; and possibly to further show that the writer, in an official capacity, was not unwilling to second his efforts in that direction—his failure in the instance alluded to being due to the opposition made by citizens of Menominee to any railway project coupled with development of the newly discovered iron beds which did not include that village as its lake terminus.

In 1871 the Chicago & Northwestern railway line was extended from Fort Howard to Menominee, and in the following year the gap between the latter village and Escanaba was closed. Until explorations revealed the existence of large and valuable deposits of iron ore in what is now known as the Menomine range, it had been the intention of the Northwestern Company to follow the bay shore route; but, with a view to the ore traffic which might ultimately be secured, the road was so located as to make the new mines easily accessible by a branch line. The line as

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built extends almost due north from Menominee forty miles, to a point within twelve miles of the Breen and Emmet mines, and from thence almost due east to Escanaba, a further distance of twenty-four miles. The legislature of 1876 granted a subsidy of seven sections of state swamp lands per mile to the Menominee River railroad company to "promote the early construction of a railroad through the Menominee iron range." The railroad thus provided for was completed to the Vuclan mine, in section 10, Town 39, Range 29, in the summer of 1877, and from thence dates the rapid progress which has characterized the development of a number of most valuable mines. In the meantime, and subsequent to the discovery at the Breen, the Lake Superior and Portage Lake Ship Canal company located a large part of the 400,000 acres donated to it by the general government, in that region, upon which have since been found many valuable deposits of ore. Under the auspices of this company surveys and explorations were made by Prof. Pumpelly and Dr. H. Credner, but their report was hardly such as to warrant the investment of capital in the new district, owing to the fact that their examinations were principally confined to the lean outcrops, which were calculated to condemn rather than commend the region, so far as the quality of its ores was concerned. Maj. Brooks, in his geological report of 1873, while conceding the quantity, left an implied doubt as to the quality of the ores, though he referred to the fact that soft hematite ores never outcrop, and left the reader to infer his belief from the closing remark that, "if pure high grade ores be abundant "in the Menominee region, they "might not yet have been found "from the little work that has been "done." That question was practically settled soon afterwards by Hon. John L. Buell, who, in 1873, made the explorations which led to the opening of the Quinnesec mine, and exerted himself with good effect in bringing the region into prominent and favorable notice. The year previous to Mr. Buell's discovery of the Quinnesec deposit, the Milwaukee Iron Company did some work at the Breen, under an option for a lease, but in the following fall or spring operations were transferred to the Vulcan, some four miles further west. The developments made by Mr. Buell and the Milwaukee company established beyond cavil the excellent quality of the ores, but the development of the mines was necessarily longer delayed by the lack of transportation facilities, which were not supplied till late in the season of 1877, and then only to the Breen and Vulcan mines. The railroad was completed to the Quinnesec the following spring. Since the beginning—three years ago—the shipments have been as follows:

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Year.	Gross tons.
1877	10,405
1878	94,245
1879	269,089
Total	373,739

Apportioned to the several mines as follows:

Breen	11,969
Emmet	33,997
Vulcan	100,367
Norway	80,395
Cyclops	52,186
Curry	12,808
Saginaw, sec. 4	13,485
Stephenson	178
Quinnesec	67,879
Total	373,739

These figures show a most gratifying progress in the work of development—one most certainly which had no parallel in the early history of iron mining in Marquette county. Remarkable as its progress has been, it cannot be truthfully said that much more than a few scratches have been made in the immense deposits which are now known to exist on both sides of the river, and we are promised much more astonishing results at the close of the present year. A number of new and valuable mines, which were not supplied with shipping facilities last year, are in course of development, and will be ready to swell the list as soon as the railway extensions now in progress are completed. Across the river in Wisconsin, every preparation is being made for the prosecution of mining operations in what are claimed to be some of the largest deposits of iron ore ever yet brought to light. On the north belt, known as the Felch mountain range, in Town 42, ranges 28 and 29, recent explorations have been productive of the most satisfactory results, giving unmistakable promise of the early development of large deposits of the very best ore in that section, while some of the present working mines cannot be said to have very nearly reached their maximum of production. This is particularly true of the Norway, of the possibilities of which in the matter of large production there is apparently no limit within the bounds of a reasonable belief. It would be the height of folly to assume to predict, with any degree of certainty, the probable output of the district in its present stage of development; nearly, if not all, the present working mines will, if no unforseen difficulties are encountered, achieve a material increase over last year's figures; in fact, it is possible that they alone may be able to double the aggregate product of 1879, but the yield of the new mines will depend in a great measure on whether they are supplied with the means of transportation early or late in the season, and it cannot, therefore, be estimated with any degree of accuracy. The writer will not be surprised if the sum total for the year exceeds, rather than falls under, the largest estimate the most sanguine friends of the range have yet ventured to place on record.

Commencing with the first in order, approaching the Range by rail, it is the purpose of the writer to review the several mines seriatim,

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giving as nearly as possible an accurate description of each, without, however, any attempt at fine writing or presuming to discuss points which are exclusively within the province of the scientist. The first in order is

THE EMMET MINE,

The name of which the writer takes the liberty of spelling with one less r than appears to have been set down in the company's articles of association, but which he believes to be the correct orthography. This is the most easterly mine on the range, the tract upon which it is situated being the northeast quarter of the northeast quarter of section 22, town 39, range 28. The vein, or deposit, lies on the edge of a swamp, and crosses the forty acre tract in a nearly east and west direction. Work was commenced in the spring or summer of 1878, by the Emmet mining company, of which the late Judge Ingalls was president, Bartley Breen secretary, and Thos. Breen treasurer. In the spring of 1879 the Breens sold their half interest in the property to the Kimberleys, of Sharon, Pa., who also leased, on a royalty, the other half interest owned by Judge Ingalls. At the same time the new owners secured a lease of the 40 acres on which the Breen mine is located, and which may now be properly considered a part and parcel of the Emmet, though the old name is still retained. At the Emmet the formation dips to the south, at an angle of about 60 degrees, which at no very great depth brings the ore deposit under the swamp. The vein has been opened over a length of five or six hundred feet, and carries an average width of about 75 feet, as near as the writer could make it without actual measurement—though the captain in charge claimed a much larger average, while the one who preceded him made it less. Certain it is that the deposit is, apparently, quite large, though its extent has not yet been fully determined. So far the work has been confined to open pits, the main one of which is about 200 feet in length, 80 or 90 feet in width, and at least 50 feet deep. There are two distinct varieties of ore, one a soft blue specular—it can hardly be denominated a soft hematite—which is about 25 feet thick, and immediately overlies about 50 feet of soft brown ore of good quality. It is, perhaps, proper to say that in estimating the width or thickness of the vein reference is had only to the width so far as shown by the workings; it is claimed, and perhaps truly, that as yet neither the foot or hanging walls proper have been found. The two qualities of ore are mostly contiguous, in only a few places being separated by narrow seams of rock or lean ore. From this main pit most of the ore shipped thus far has been taken, the workings east and west of it being yet near the surface. Enough has been done in the east end, however, to show that the pyritous ore, which

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there occurred in the beginning, has disappeared, leaving the deposit in that quarter of uniform good quality. That the ore is of exceptional good quality is shown by analyses made by Chas. E. Wright, M. E., and which are here appended, being taken from his first annual report as mineral commissioner. The first is of the soft blue specular, and the second an average from a large number of samples of the brown ore :

No. 1.

Oxide of iron	93.85
Alumina	.72
Lime	.87
Manganese	.60
Sulphur	.09
Phosphoric acid	.11
Silica	1.40
Carbonic acid, etc	2.36
	100.00
Metallic iron	65.70
Phosphorus	.047

No. 2.

Oxide of iron	81.570
Oxide of lime	3.150
Oxide of magnesia	1.800
Sulphur	.056
Phosphoric acid	.295
Silica	5.550
Water, carbonic acid, etc	7.579
	100.000
Metallic iron	60.33
Metallic phosphorus	.129

The mine presents at present anything but an inviting appearance; bears upon its face, in fact, the evidence of having been subjected to a severe course of gouging, in order to obtain as much ore as possible at the least expense and with the aid of the most primitive and inadequate machinery. But very little dead work appears to have been done since the close of navigation, and the management appears to be "at all fours" in respect to a plan of operations for the future. The mine is a very wet one, owing to the fact that the deposit dips under the swamp, the water from which seeps into the openings through a hanging wall which appears to be little else than the up-turned rim of the basin occupied by the swamp. At first, the conundrum was how to obviate this great flow of water from the swamp; but latterly a more serious question has presented itself for practical solution. In reference to the first problem, it was decided to construct a bulkhead along the front of the workings, and for this purpose a strip of earth of suitable width was removed from along the southern edge of the open cuts, on what was supposed to be the foot wall. It is found, however, that the foot wall falls away abruptly into the swamp, only the sharp up-turned edge of it cropping up between the sedimentary deposits of the swamp itself and the ore vein. A bar twenty feet long can be driven perpendicularly down, only a few feet from the open face of the mine, and on what ought to be the foot wall, without meeting any other obstruction than that of the soft muck. In view of this fact, it would be the height of folly to attempt to work the main pit, or indeed any part of the mine, to a greater depth, in open cuts. There appears to be but one solution to the difficulty, and that is to adopt the underground system of mining, through which means both the questions referred to may be satisfactorily solved. If there

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is a mine anywhere that needs the services of a thoroughly skilled and practical miner, as superintendent, that mine is the Emmet.

A mistake was made in the beginning—the derricks, engine house, side tracks and docks, all having been placed on the hanging instead of the foot wall side of the openings. It is not to be wondered at, however, that the original owners did not adopt the underground system at the start; the present dangerous character of the hanging could not have been foreseen, and being possessed of a limited capital, they could not afford to expend any part of it in definitely ascertaining the extent and position of the vein, with a view to the final adoption of this or that system of mining. Since the new owners took hold of the property the demand for the product of the mine has been such as to leave them little time in which to devise plans for future operations. The mistake referred to is, however, being corrected as rapidly as possible. The hoisting machinery, which a short time ago consisted of a diminutive engine, two small drums and as many derricks, was found wholly inadequate for the work, and a new plant has just been placed on the foot wall side of the principal opening. This plant consists of a 12x18 engine and four 3-foot drums, manufactured by Frazer & Chalmers, Chicago. This machinery was first set in motion on the day of the writer's visit to the mine, and though slow, and by no means to be compared to that employed at some of the other mines, is a great improvement over the old plant. A duplicate boiler, and two more drums will be added, at an early day, and it is expected that with this addition the new machinery will answer every requirement of the mine for years to come. At present, the hoisting is done in buckets, with the aid of three derricks, but it is the intention to put in a couple of skip roads on the foot wall, and more, if they shall be found necessary. Altogether, the mine is a most promising one, but the formation and position of the ore belt is such as to require the greatest practical skill in the successful prosecution of mining operations. The writer may be pardoned for expressing the fear that such practical skill is not at present particularly noticeable in the immediate conduct of operations—nor is it intended to reflect in the least on the present mining captain, who makes no pretense to a practical knowledge of mining. All the mine needs to make it largely productive and profitable is a practically skillful superintendence; without that the future is fraught with the greatest danger.

E. B. Foster, Esq., is the present agent and superintendent, while Arthur Stevens fills the position of mining captain, lately resigned by Captain Elijah Roberts.

The Breen mine, and the explora-

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THE BREEN MINE.

This property consisted originally of one hundred and twenty acres—the north half of the northwest quarter and the northwest quarter of the north east quarter of Section 22, Town 39, Range 28—the mine, as originally opened, being located on the first named tract. The Breen mine proper, as has been stated, is now under lease to the Emmet Mining Company, the Breen brothers having taken an option for a lease of the remaining 40 acres, and upon which they are now prospecting with a fair show of developing a good mine. It was at the Breen mine that the original discovery of ore was made in 1867—at least the first discovery of which the writer has any knowledge—and it was here that the first practical explorations were made and the first mining done. In 1870 S. P. Saxton, now a resident of the Range, put down several test pits and cut two long trenches across the formation with such favorable results that the Milwaukee Iron Company entered into a contract for a lease with the owners, and under its terms continued the explorations. The Menominee Mining Company succeeded the Milwaukee Iron Company, and in 1877 shipped from the mine 5,812 tons of ore. In the spring of 1878 the Menominee company surrendered its lease, the mine passing back into the hands of the Breen company, by which mining operations were continued with but indifferent success.

The formation at this mine is very irregular, and the veins, as far as shown by the present workings, so narrow and broken as to preclude the possibility of the mine ever proving one of very great value, in the absence of other and more promising developments. In the pit nearest to the Emmet openings, what at first appeared to be an extensive deposit of soft blue specular ore, of fine quality, appears to have given out at a depth of only a few feet, being underlaid with sandstone. It is claimed, however, that this sandstone overlies the regular vein or deposit, which claim appears to be substantiated by the fact that a shaft in the bottom passes through only a few feet of the sandstone and reveals the existence of very good ore beneath it. It is improbable that the Emmet vein, which has been opened to within a stone's throw of the eastern pit of the Breen, suddenly narrows down, or becomes altogether extinct, in so short a distance. It is more than probable that further work will show the vein to be continuous, and that by sinking and drifting in the east opening of the Breen a deposit of ore as large and valuable as that of the Emmet will readily be found. In the west pit, at the time of the writer's visit, a small party of miners were "scramming"—removing much more rock than ore—and from a casual glance at the pit a person having some knowledge of mining would at once jump at the conclusion

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that there was scarcely enough ore to be seen to warrant a continuance of mining operations. From this pit, however, nearly all the ore shipped from the mine has been taken. It may be that, as the miner's claim, there is good ore in the bottom; but the writer must confess that at this point he saw very little of an encouraging character save what appears to be a narrow vein of good ore extending westward from the open cut and along the base of the hill. A drift from the open cut near the north side, extending westward about 150 feet, reveals some good ore, but hardly enough to warrant the prosecution of mining in that direction. The probability is that the main deposit—possibly one of large extent, lies at the base of the hill, and directly in front of the present openings. The course of the ore belt at the Emmet certainly points to this conclusion, and, notwithstanding the present apparently unfavorable outlook, the probabilities are all in favor of the Breen ultimately becoming a most valuable mine. A continuation of work west from the Emmet will soon determine the question as to the east pit of the Breen, and from that point it will be a comparatively easy task to trace the exact course of the ore belt to the western limit of the company's leasehold. The writer has seen "sicker" looking properties than the Breen live and flourish and become more and more productive year after year, and he will not be astonished should future work place it among the most prolific mines on the range.

Appended is an analysis of the ore taken from commissioner Wright's report:

Oxide of iron	83.86
Oxide of lime	2.70
Oxide of magnesia	1.60
Sulphur	.02
Phosphoric acid	.10
Silica	6.76
Carb. acid, &c	4.96
	100.00
Metallic iron	58.70
Metallic phosphorus	.044

EXPLORATIONS.

East of the the Emmet, on the northwest quarter of the northwest quarter of section 23, town 39, Range 28, S. P. Saxton is engaged in making some explorations in the hope of finding the Emmet vein. At the time of the writer's visit, early in the month, the miners were drifting south from the bottom of a shaft 50 feet in depth, through the soapstone, which was rapidly growing harder, a fact that was considered an excellent indication of a near approach to the ore. The shaft and drift are in very wet ground, on which account the work had been considerably delayed until a steam pump could be procured and placed in position. A failure to strike the vein would seem to be improbable; the formation and character of the rock point most unerringly to the existence of ore in the near vicinity, and the right course is being pursued to insure its discovery. It is possible, even probable, that the vein may have been cut before this meets the eye of the reader.

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Mr. Saxton's perseverance merits success, and no one will regret to hear that he has struck a real bonanza.

West of the Breen, on the option taken from the Breen company, the Breen brothers have put down an exploration shaft, near the railway, in which a fair quality of hard ore has been found, but which is hardly rich enough, judging from the pieces shown us, to rank above second class. The extent of the vein is, of course, not definitely known; neither is it safe to judge of the quality by the specimens taken from the outcrop—the samples may, however, as we are assured is the fact, have been what was left after the best specimens had been taken away—in either case, it is possible that a very little work may reveal ore of a much better quality. The shaft, like all the others in this part of the range, is very wet, and at the time of the writer's visit a force of men were engaged on a "working shaft," it being the intention to use the first for pumping purposes only. A steam pump is found necessary to raise the water. It will not be surprising if a body of very good hard ore should be developed at this point.

The development of these mines, giving employment to some two or three hundred men, has been accompanied by the growth of a neat little village called Waucedah, which boasts a post-office, two hotels, two general dry goods stores, one confectionery and notion store, one meat market, one jewelry store, two public halls and the usual number of saloons. The buildings are more substantial than those usually seen in new villages, the location is a pleasant one, and should the Emmet and Breen mines pan out as well as anticipated, and, as is altogether likely, a number of new ones be developed in the near vicinity, Waucedah will expand into a town of considerable importance.

THE VULCAN MINE

Is the first of the Menominee Mining Company's series of mines encountered as the Range is entered by rail. It is situated about six miles west of the Breen and Emmet, and was originally known as the Breitung mine—the first opening being made on lands leased by the company from Hon. Edward Breitung, in section 10, town 39, range 29. The first work was done in 1873, but of course little more was done than to locate the deposit until after the building of the Menominee River railroad became a certainty in the spring of 1877. The road was completed to the mine in August of that year, between which time and the close of navigation the company shipped 4,593 tons of ore.

The Menominee Mining Company, it is well to remark right here, owns, either in absolute fee or in leasehold, no less than six of the principal mining properties on the range—the Vulcan, Clyclops, Norway, Quinnesec, Chapin and Florence—from four of which was ship-

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ped, in 1879, 218,706 tons of the approximate value of $874,824. The officers of this company, a corporation owning mines capable of a much larger production than those of any other on the peninsula, are as follows:

Directors—J. J. Hagerman, J. H. Van Dyke, Albert Conro, Douglas Van Dyke, A. C. Brown.

President—J. J. Hagerman.

Vice President—J. H. Van Dyke.

Sec'y and Treas.—G. D. Van Dyke.

Agent—A. C. Brown.

Superintendent—N. P. Hulst.

Ass't Superintendent—Jeff. Day.

It is the purpose to review each of the mines belonging to this company in regular order, commencing with the Vulcan, which is, perhaps, as favorably located as any on the range. The deposit lies near the summit of a hill, and enjoys the best natural advantages for drainage, as well as for the economical shipment of the product after it is raised to the surface. The original opening was, and is, entered through a tunnel some fifty or sixty feet in length, and at least thirty feet above the level of the railway track, to which the ore passes over a gently descending narrow guage tramway, being dumped direct into the pockets and from thence readily loaded into the cars through chutes. This tunnel cut the ore deposit at a depth of about 50 feet from the outcrop, but the ore has all been worked out to a depth of fifteen or twenty feet below the tunnel level. The original opening consisted of a pit about 250 feet long, and at least 75 feet wide near its center, and for a time presented more the appearance of a huge pocket than anything else—the vein or deposit narrowing down to the east and west—in fact, a crossing of rock in the east end appears to have cut the ore out almost entirely. This last would be a fair inference, at all events, from the fact that mining operations are not being prosecuted in that direction. In the west part, however, the vein, though narrower than might have been anticipated in the beginning, is wide enough for all practical purposes—better, indeed, than if much wider, because of the less difficulty there will be in supporting the walls by timbering, the leaving of pillar supports being practically out of the question. At the time of the writer's visit the miners were sinking in that part of the deposit, and doing other work preparatory to an effective summer's campaign. These remarks have reference only to the original opening on section 10, from which the greater bulk of the ore thus far shipped has been taken, but which is really a small part of the whole mine as at present constituted. To the west, on the southeast quarter of the northeast quarter of section 9, the vein has been opened along a distance of at least 500 feet, being continuous, with the exception of one or two rock crossings, which will be found an advantage rather

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than obstruction as mining operations progress. The vein has been traced for a considerable distance further west than the point to which it has been opened, and carries an average width of perhaps twenty feet. The workings in this quarter are as yet mainly confined to surface openings, with the exception of two working shafts which are going down on the foot wall, and in which skip-roads will be placed probably by the time the new machinery, now on the ground, is in position. It should be remarked that the writer speaks of the vein in this part of the mine simply from the standpoint of what the open cut reveals. It is not improbable that future work may reveal a much greater width of vein, and that at one or two points, especially, what now appears to be the foot wall may prove to be only interjecting horses of rock, which will be cut out by the ore at no very great depth. The vein dips to the south at an angle of about 45 degrees, and a great deal of timber will probably be required to support the hanging. Fortunately that is abundant and cheap. The ore from this part of the mine is taken out on tramways connecting with a double track incline to the shipping pockets. This incline is so arranged that the loaded cars descending draw the empty ones up with the greatest ease and facility. As mentioned, two working shafts are being put down in this part of the mine, and a third will follow very shortly. The new machinery consists of an engine 14x20, with three drums 4½ feet in diameter. These will be employed in hoisting the ore over as many skip-roads, as soon as the latter are supplied, in the meantime operating the derricks, of which at present there are only two, including the one in the old opening. It would be idle to speculate upon the probable output of these two openings the present year, but it is safe to say that they alone can be made to very materially enlarge on the figures attained in 1879. By the opening of navigation both will be in the very best possible condition for rapid and economic work, and the writer can only be astonished by a falling off rather than by a large increase in product. The ore is of exceptional fine quality, much sought after by furnacemen, and with the care that is exercised in mining can never go begging for purchasers. The following is a partial analysis of the Vulcan ore made by Charles E. Wright, and printed in his last report:

Metallic iron	62.20
Insoluble silica	5.84
Soluble silica	
Lime	1.31
Phosphorus	.022

No. 2 is an opening nearly half a mile east of the ones above referred to, on the northeast quarter of the southwest quarter of 10, in which some work was done in 1878, but which has not been wrought during the past year. Preparations are being made, however, for a renewal of operations in this quarter, where a

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good workable deposit is known to exist. A portable boiler and one of Merritt's improved drums are on the ground, and will be set up at an early day, when mine work will be renewed, and, it is believed, good results will certainly follow. This opening is nearest to the railway station, about which a considerable unincorporated village is growing up.

Nearly, if not quite, a mile east of No. 2, on the south half of section 11, a vein of very fine ore similar to that found at the other openings, except that it appears to be considerably harder, has been stripped for a length of over 200 feet. This vein carries a width, so far as exposed, of thirty-five feet, dips slightly to the north, and has been traced a considerable distance east and west from the cut now being made. The indications point strongly to the existence of a very large deposit of excellent ore at this point, and preparations are being made to commence active mining operations at as early a day as may be practicable. Some three or four hundred tons of ore have already been taken out of a shaft sunk to a depth of about 50 feet on the hanging wall side, and there can be no doubt that by the time a side-track, some half a mile in length, can be put in, the "East Vulcan," as it is called, will be ready to contribute most liberally to the aggregate product of the mine. Boarding houses are being erected, a boiler and one of Merritt's interior gear hoisting drums are on the ground ready to be set up, and by the opening of navigation mining will be commenced on a scale commensurate with the apparent extent of the deposit.

Still further east, about a quarter of a mile, another opening is being made on canal lands, the option for which the company purchased of Messrs. Frederich and Curry. Here also there appears to be a good deposit, which is being stripped. The ore is of about the same quality as that in the opening last described, but seems to have a contrary dip—to the south. Here two boarding houses are being erected, and preparations made for setting up a boiler and hoisting machinery already on the ground.

Altogether, the writer could see nothing at the Vulcan, either in the condition of the openings or in the local management, that merits other than favorable criticism. It is doubtful if the captain in charge, Jerome Schwartz, had been possessed of the power to see plainly through a hundred feet of drift and rock, he could have done better in opening the mine in its different parts. No mistakes are discernible, and the owners of the mine would be captious indeed did they express other than unqualified satisfaction with the present outlook at the Vulcan. The mine may be considered, in the absence of any untoward circumstances yet to intervene, good for a product of at least 90,000 tons the present year.

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THE CYCLOPS MINE

Is the next of the Menominee mining company's mines, in regular order. The first work at the Cyclops was done in October, 1878, in which same year there was shipped 6,028 tons, supplemented by 46,158 tons in 1879. In the beginning it was believed to be one of the most remarkable mines on the range, which belief was well founded in the fact that within thirty days after the commencement of work, it had achieved a daily average product, produced at a merely nominal cost, of 150 tons. The yield for 1879, however, does not appear to have fully met the expectations justly entertained at the close of the present season. The original opening is on the south-eastern slope of a hill, the vein having a nearly east and west strike, and dipping about 45 degrees to the south. This opening, which has been made in a vein or deposit about 30 feet in width near the surface, has very nearly pinched out at a depth of not much, if any, more than 50 feet. At a considerable distance east of this opening a shaft has been sunk to about the same depth, at which point the vein appears to have been subjected to the same process of pinching, though there is yet considerable ore in the bottom. At this point the work is all underground, on a stope that is being carried westward towards No 1 opening. All the ore that can at present *certainly* be considered in connection with the yield of the mine the present year, so far as the writer could see, is embraced in the vein lying between this opening and the east shaft, and above the present bottom. It is by no means certain, however, that developments yet to be made may not bring about at least a partial realization of the expectations held in the beginning. A diamond drill is now at work boring in the hanging wall, at an angle of 72 degrees, at which angle it will strike the foot wall at a depth of about 150 feet below the present bottom of the open cut. It is believed, and with reason, that if the vein does not again widen out below the present level of the mine, the drill will reveal the existence of other deposits, above what now appears to be the hanging, or below the present apparent foot-wall. The writer has known instances in hematite mines on the Marquette range, where accident has revealed the existence of large ore deposits but a few feet beyond apparently solid rock walls, and where, perhaps, the ore would still remain but for the accident which brought it to light. In one of these instances, at least, the accidentally discovered deposit proved to be of greater magnitude than that which had been originally opened; indeed, new and valuable hematite deposits are being discovered every year on some of the oldest mining properties in Marquette county. The writer would not, in view of these facts, be justified in uttering a single word of disparagement concerning the

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Cyclops because of the apparent pinching out of the vein at one or two points. The work thus far done can hardly be considered other than merely a partial exploration. Notwithstanding, therefore, the present, dubious outlook, the writer will not be suprised if the future of the Cyclops should prove all that could reasonably have been expected in the beginning.

The machinery consists of a small engine and three small drums, operating the same number of derricks. The ore is of a very superior quality, as shown by the following analysis taken from Mr. Wright's Report:

Oxide of iron	95.90
Oxide of manganese	Trace
Oxide of lime	.36
Oxide of magnesia	.39
Alumina	.62
Sulphur	.01
Phosphoric acid	.04
Silica	1.20
Undetermined	1.47
	100.00
Metallic iron	67.13
Metallic phosphorus	.018

THE NORWAY MINE

Is located on the north-east quarter of the south-east quarter of section 5, town 39, range 29—in the same half section, and in close proximity to the Cyclops. It is on lands owned by the canal company, but is being operated under a lease to the Menominee Mining Co. This lease embraces all of the section, except two hundred acres in the north half, and from present appearances may justly be considered one of if not the most valuable mining tracts on the whole range, east of the river. It may be that other properties now in course of development will prove equally as extensive, and prolific in yield, but it is certain that none of them will be able to very nearly approach the Norway in the matter of product the present year. Some idea of the extent of the deposit may be gathered from the fact that, although the first work was done in August, 1878, after which time it was necessary to build a switch track one mile in length, shipping docks, pockets, tramways, &c., in a little over a year the mine has produced and shipped 80,895 gross tons of ore, 73,619 tons of which was raised and shipped in 1879. In addition to this, at this date, (February 18th, 1880,) although several thousand tons have been shipped since the close of last year's report, the stock piles embrace not less than 40,000 tons, and are being augumented at the rate of nearly, if not quite, 600 tons per day; this, too, notwithstanding the fact that a great deal of dead work is being done, the quantity of rock raised very nearly equalling the amount of ore taken out. It is believed, and with reason, that by the opening of navigation in the spring, the mine will be in a condition which will insure an average daily product of very nearly, if not quite, 1,000 tons—a record never before achieved by any iron mine within the knowledge of the writer.

The ore formation has an east and west trend, and is very irregular, the dip being to the south. There are two kinds of ore—one a soft blue specular, and the other a hard, steely

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variety somewhat similar to the red speculars of the Ishpeming group. The latter, however, embraces but a small fraction—not more than 10 per cent.—of the entire product. An analysis of the soft ore, made by Mr. Hulst, the company's mining engineer, was as follows.

Oxide of iron	85.209
Alumina	2.209
Lime	4.160
Magnesia	.620
Sulphur	.022
Phosphoric acid	.040
Silica	7.500
Metallic iron	59.64
Metallic phosphorous	.018

Another analysis made by Mr. Wright, and printed in his report, gave:

Metallic iron	63.50
Metallic phosphorous	.017
Silica	7.520

As stated, the deposit is very irregular. The first opening was made near the east line of the section, in an open pit, since which time the deposit has been opened in shafts and open cuts along a distance of 1,400 feet. In the east end there appear to be two separate and parallel veins, with about 100 feet of rock between, both veins dipping at about the same degree to the south. These veins carry an average width of about 15 feet of good ore, and are being mined on the underground plan, through four shafts—or rather will be, when all the shafts are supplied with the necessary skip-roads. These shafts are either down, or going down, to the second or 120-foot level, the ore on the first level, between them, having nearly all been taken out. Some four or five hundred feet west these veins appear to form a junction—at all events, an open cut in the north vein shows that the ore abruptly pitches to the south under what, but for a knowledge of the existence of the south vein, might have been mistaken for a foot wall. At this point, at all events, the intervening rock is being removed, indicating a belief on the part of the management that the veins here come together and form a wide deposit. Indeed, a cross-cut at a depth of about thirty feet has been made nearly all the way in ore between what, on the surface, were two separate and distinct veins or deposits. Still farther west the deposit has been uncovered over a width of about sixty feet, gradually widening out still farther to the west to a width of over one hundred feet between the walls. Here is a large open cut, at least 200 feet in length and from 60 to 100 feet in width, which is gradually being extended as the stripping progresses further west. Though the deposit at this point is very large, its extent has by no means been definitely ascertained—the ore, however, having been found as far west as any explorations have been made. In some places the deposit is capped over with rock, and there is here and there to be found a pocket or "horse" of lean ore or rock in the bottom. It is noticeable, however, that this rock and lean ore is so placed as to give little trouble other than that of the cost of raising

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it from the mine. It would be too much to expect nothing but pure ore in so extensive a deposit as that under consideration. As it is, it is certainly the largest deposit of ore the writer has ever seen exposed within the same area. Whether the ore or rock will predominate at a greater depth is, of course, a question that only future work can satisfactorily determine. Let that be as it may, this deposit, taken in connection with the other parts of the mine, fully justifies the management in its estimate of a product of not much, if any, less than 200,000 tons the present year. It is probable, however, that the deposit is spread out too thin to hold its present width to any very considerable depth. Indeed, it would be much better, looking to the future successful working of the mine, if this probability should at an early day become a certainty, for the reason that it is questionable if so wide a deposit can be economically wrought to any great depth, owing to the impossibility of supporting the hanging, which will most probably be found rather shaky. It appears to be the opinion of mining experts who have examined the mines on the range, that veins carrying a width of not over twenty-five feet are much preferable, owing to the greater ease with which the walls can be secured. On this principle it is to be hoped that this apparently immense deposit will, at a convenient depth, be found condensed into narrower limits between regular and well defined walls. Such, the writer believes, will prove to be the case; and it is the only theory upon which years of profitable production can safely be predicted for that part of the mine.

The machinery now in use are two engines—one 11x16, and the other 10x20—situated in No. 1 and 2 engine houses, located on the north or foot-wall side of the opening. In each of these engine houses are six 30-inch drums, only ten of which, however, are being used to operate as many derricks, the hoisting at present all being done in buckets. At the time of the writer's visit the ground was being cleared for a new engine house, about midway between the other two, in which will be placed a 200 horse-power engine, which has been ordered, and several large drums, probably of Merritt's interior gear make. These are designed to operate a number of skips running on skip-roads on the incline of the the foot-wall. It is the intention to put in as many of these skip-roads as may be necessary to do all the hoisting for the mine, and as soon as possible to dispense with the derricks now in use. Skip-roads will also be placed in two of the shafts east of the open cuts, if not in all of them. The mine is a comparatively a dry one, and but little difficulty is experienced from water.

The ore taken from the upper part of the mine is conveyed to the shipping pockets and stock-piles adjacent, over two double-track incline tramways, one on the hanging, and the

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other on the foot-wall side; these are so constructed that the loaded car descending draws the empty one back to the top of the incline. The lower end of these inclines are at least 30 feet above the railway, affording ample room for stocking the winter's product. The mine, tramways and stockpiles, are lighted at night by 13 electric lights, an 18 light Brush machine being located in a small building adjoining No. 1 engine house. The system gives perfect satisfaction, the lights being so arranged that they can be readily removed when it is necessary to get them out of the way of a blast. A telephone line connects the office with the headquarters of the company at Vulcan, and will shortly be extended to all the other mines owned by the company. The mine at present gives employment to something over 400 men, a force which will be materially increased on the opening of navigation. The company has the full complement of boarding houses and tenements for the accommodation of its employes, and is now erecting a large warehouse, a blacksmith and machine shop, and will also build and fill with a stock of general merchandise a store from which to supply the needs of the miners.

The mine was opened under the immediate superintendence of Capt. Thos. Williams, a miner of many years' experience, and who remained in charge until a few days ago, when he resigned and has since accepted the position of general superintendent of the Lumberman's Mining Company's mines. The Captain is a worker as well as a first-class miner, and his loss to the Norway can but be considered a great gain to his new employers. At the time of the writer's last visit, Capt. Jeff. Day, Mr. Hulst's assistant, was in charge.

Altogether, the Norway is the most remarkable mine ever yet developed on the upper peninsula, promising, in what may practically be considered the second year of its history, a product never before achieved by any other mine of which the MINING JOURNAL has a record.

THE QUINNESEC MINE

Is located on the south-east quarter of section 34, town 40, range 30. The first explorations on the property were made in 1873, by John L. Buell, Esq., who put down several test pits and sunk a shaft which proved the existence of ore on the property in paying quantity. During the following winter the quality of the ore was demonstrated by a practical test in the Menominee furnace, to which a sufficient quantity for that purpose was transported in sleighs. Like the other deposits in the district, the development of the Quinnesec was delayed for want of transportation to the lakeside, which was not secured for several years after the value of the property had been practically demonstrated. In the meantime the Menominee Mining Co. secured a lease, and began

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stripping the vein preparatory to the opening of the mine. The railroad was completed to the mine in the winter of 1877-8, and the first shipments made early in the spring of the latter year. Since then the shipments have been as follows:

1878	25,995
1879	41,884
Total	67,879

Work was commenced at the Quinnesec by carrying an open cut into the east side of the hill, which gave a stope of about 40 feet, the whole width of the vein, the outcrop being at least 200 feet above water level. The bottom of this open cut constitutes what is now called the first or upper level of the mine, the ore from which was taken out on a double track incline tram-road, 700 feet in length, to the docks, from whence it could be dumped directly into the stock-pile or into the railway cars underneath a trestle work some fifty feet in height. This tram-road, which is still in operation, is so arranged that the loaded cars going down draw the empty ones up. In the beginning a large amount of stripping was done which might better have been omitted, considering that it has since been found necessary to adopt the underground system of mining. The writer of this, when he first visited the mine in May, 1878, referred to this fact, and then pointed out the mistake that had been made in opening the vein. It was an error, however, for which the present mining captain was in no wise responsible, and one which, in the absence of any positive knowledge of the extent of the deposit or of the character of the enclosing walls, would have been no reflection on the ability of the most careful and experienced miner in the district. The formation is a peculiar one. The ore dips about 70 degrees to the north, the overlying rock being a sandstone, immediately under which there is a thin stratum of ore of no market value. The deposit is of variable width, the average being probably 20 feet. The walls, particularly the hanging, are of such a character as to require a large amount of timbering, but so far they have been most skillfully and amply secured, the record of the mine showing no loss of life or limb to any employe since the beginning.

On the upper level the first workings were in an open pit nearly 100 feet long, 35 feet wide and 40 feet deep. At the west end of this open pit the vein or deposit was cut by a crossing of lean ore and rock, which led many into the belief that the deposit was not nearly so extensive as at first supposed. Having worked the ore out to a depth of some 40 feet, the underground system was inaugurated, and to-day the mine is being worked on four levels below the bottom of the original open pit. There are four shafts, about 140 feet apart, numbered respectively 1, 2, 3 and 4. Number one shaft starts from the bottom of the old pit, and is down to the fifth level, 175 feet.

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Number three is east of number one, numbers two and four to the west of it, and all three down to the fourth level, and on their way to the fifth. Between shafts number one and three two winzes connect the third and fourth levels, and half way between two and four another winze is down from the first, or incline, to the second or adit level. An adit, or tunnel, which was commenced early in 1878, has been carried through the side of the hill into the east end of the deposit, and through it a distance of 750 feet, and constitutes the second level of the mine; on this level there is a tramway the whole length, connecting with a trestle work and pockets alongside those already referred to, over which a considerable portion of the product of the mine finds an outlet. Above this second level, nearly all the ore has been taken out, leaving only a sufficient body to form a roof, but which can be removed at some future time. The third level has been opened over a distance of 550 feet, and above it there still remains considerable ore to be taken out. In opening this level, by drifting to the west, the ore was found to extend a considerable distance under the rock crossing at the west end of the open pit, and though the fact has not yet been fully demonstrated, it is believed that on the fourth level the rock will entirely disappear. Very little stoping has been done on the fourth level, on which a whole summer's work remains to be done, while the stopes in the fifth will not be commenced upon until some time in the spring. The ground at the east end of the third level, at which point there is a rock crossing similar to that at the west end of the open pit, is poor; but it is confidently expected that good ore will again be found at this point, on the fourth and fifth levels. Between shafts 1 and 3 there is a good body of ore, on the fourth level, as also between numbers 1 and 2 on the same level, and between 2 and four on the third. No. 2 shaft is in rock down to the third level, from which point a stope is being carried west in 25 feet of ore.

The writer, previous to his recent visit, had heard it whispered that the Quinnesec deposit was about exhausted; but, after an inspection of the mine, descending as he did to its deepest parts, and being shown through the various drifts and examining the stopes, gives it as his unbiased opinion that there is more of value in the mine than even its owners care to acknowledge. The development at the west end, on the third level, showing that the ore extends under the rock crossing at that point, is suggestive of large possibilities, even probabilities, in that direction. It is not improbable that the deposit will be found to rise nearer the surface some distance west of the rock crossing referred to; but should it be otherwise, there is still enough ore in sight to assue a permanency extending over a period

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of many years. The ore is of the soft, specular, blue colored variety, and of a very superior quality, as is shown by the following average analysis, taken from Mr. Wright's report:

Metallic iron	65.70
Alumina	.80
Lime	.66
Manganese	.15
Phosphorous	.03
Sulphur	.02
Silica	2.10

The machinery at the mine consists of a Corliss engine and three of Merritt's interior gear drums, which operate in skip-roads in Nos. 1, 2 and 3. A whim and derrick is used for hoisting from No. 4. One of Brush's electric machines furnishes light to some parts of the mine, it being the intention to extend the wires to all the stopes, as soon as it can be done with advantage.

The writer cannot close this article without, a deserved compliment to Capt. Elisha Morcom, who is in immediate charge of the mine. The insecurity of the walls, together with the soft character of the ore, making pillar supports an impossibility, demanded the exercise of the greatest skill in the prosecution of the work. The present condition of the mine will convince any expert that Capt. Morcom thoroughly understands his business; and the fact that thus far no accidents other than those of a trivial character have occurred, is perhaps still better evidence of his skillful ability as a miner.

Of the output of the mine the present year the writer will not venture a prediction, further than to say that he will miss his guess if the figures do not show a gratifying increase over those of 1879.

The mine is situated near the pleasant and thriving village of the same name, and at the present terminus of the Menominee River railroad. The village contains a population of somewhere from 500 to 1,000 people, and is the centre of a very considerable trade, aside from that connected with the mines. It has a commodious hotel, several dry goods and grocery stores, a drug store, an opera house, school house, printing office, one or two churches, and a number of very neat residences. The future growth of the village will, however, depend largely upon the development of other mines in the near vicinity, since it will soon cease to be the terminus of the railway, and will necessarily by reason of that fact lose much of the trade it now controls. Though it may never become a large city, it will nevertheless continue to be a town of no little importance so long as the iron and lumber interests of that section continue to prosper and flourish.

THE CHAPIN MINE

Is one of the new properties being opened by the Menominee Mining company, and is situated on the south half of the southwest quarter, and the southwest quarter of the southeast quarter of section 30, town 40, range 30, about four miles north

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of west of Quinnesec village. The fee is owned by H. A. Chapin, an old resident of Niles, Mich., the interest of the company being that of a leasehold for a term of years. Explorations on the property were commenced about the middle of July last, since which time a very large body of the best ore in the district has been so far developed as to warrant the purchase of an elaborate and expensive plant of machinery, and the making of all necessary preparations for the prosecution of mining operations on an extensive scale in the future. The deposit, which lies on the north side of a hill, the summit of which is at least two hundred feet above the level of the railway, has been traced, and partially opened, over a length of at least 1,800 feet. The first discovery was made on the line between sections 30 and 31, about 400 feet west of the east line of the company's tract. At this point an exploration pit was commenced on the foot-wall, the top of which last is on section 31, and was carried down through 50 feet of surface and 32 feet of ore, the vein being apparently only about 4 feet in width. From here the explorations extend westward, down the northwest slope of the hill, to the length already mentioned. The workings at present consist of seven shafts, numbered respectively from 1 to 7, from east to west. Number 1 is an enlargement of the exploration pit already referred to, if the writer's notes are not at fault, and is now working in a blue ore of very fine quality. Number 2 is 120 feet west of number 1, and is down 170 feet, 90 feet perpendicular to the foot-wall, and the balance of the way on the pitch of the vein, which is to the north. This shaft penetrates about 80 feet of drift, (sand and clay) and the balance of the way is in ore. The vein appears to be narrow, though as yet no cross-cutting has been done at this point to determine its exact extent. Number 3 is 100 feet west of 2, is down 150 feet on the pitch of the vein, and is connected by a drift with number 2, on the first, or 150-foot level. Being on lower ground the depth corresponds with that of number 2, which starts in ground correspondingly higher. As suggested, this shaft is down to what will constitute the first level of the mine, a fact that miners will hardly be able to comprehend except it is stated in the same connection, that at least half of the ground above this first level is drift, leaving only about 70 feet of ore, a part of which must be left for a roof. Number 4 is 95 feet west of number 3, and connected with it by a drift on the same level. Number 4 is a test shaft, and being on lower ground reaches the first level at a depth of 135 feet. Midway between 3 and 4 a cross-cut shows 30 feet of clean blue ore between the walls. Between numbers 1 and 3 there are two kinds of ore—blue and red—the latter lying in the

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upper part of the vein and gradually giving place to the former. A winze, near number 4, has been sunk 40 feet below the first level, all the way in blue ore, showing so far 100 feet of ore in depth at this point. A drift has been driven west from number 4 125 feet towards number 5, on the first level, and all the way in the ore. Number 5 is 280 feet west of number 4, and is down 90 feet, and sinking to the first level, above which, at this point, there will be about 40 feet of ore. Number 6 is 324 feet west of number 5 and is down 60 feet on the north side of the vein, the last 20 feet being in ore. From the bottom of this shaft, when down to the first level, a drift will be run south to the foot wall, on which a permanent working shaft will be sunk as soon as the width of the deposit and the exact location of the foot wall is definitely determined; until then, the present No. 6, shaft will be used for hoisting purposes. No. 7 is 335 feet west of No. 6, and is down 40 feet, the last six feet being in clean blue ore. This shaft, being at the foot of the hill, the distance from the surface to the first level of the mine is, of course, correspondingly less, as compared with the shafts higher up. The lay of the vein seems to correspond somewhat with that of the surface since the workings show that while there is at least 70 feet of ore above the first level at shafts 2 and 3, it sinks away to only a few feet above that level at No. 7. All the shafts are substantially timbered, though only three of them are designed as permanent hoisting shafts; they will all be used for that purpose, however, until such time as the permanent system decided upon by the management can be fully perfected. Most of this work has been done during the past winter, and much credit is due Capt. Morcom, and his assistant, Capt. John Wicks, for having in so short a time placed this new mine in condition for a large and economical production. Much work remains to be done, however, to fully open the mine, it being the intention to connect all the shafts by drifts on the first level, and do such other work as may be necessary to give stopes east and west from each of the shafts. When this is done the way to a large annual product, independent of the ore above the first level, will be simple and easy. Altogether, the writer regards the Chapin as one of the most remarkably valuable mining properties on this most remarkably prolific iron range. The ore is of a very fine quality, fully equal to the best on the range, as is attested by the following analyses made from average selections by Charles E. Wright, analytical chemist:

	No. 1.	No. 2.
Metallic Iron	64.57	68.88
Phosphorus	.012	.01
Lime	.74	1.04

The hoisting plant, which is now being put in position, consists of a 16x42 Corliss engine, manufactured

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by E. P. Allis & Co., of Milwaukee, two 54-inch boilers, and six 4-feet drums, the latter manufactured by Frazer, Chalmers & Co., of Chicago. A side track from the main line of the Menominee River railroad extension passes along the foot of the hill, to which the ore from the shafts passes over a double-track incline tramway, operated on the same principle as those at the Vulcan and Quinnesec. At the foot of this tramway a capacious dock has been built, upon which the winter's product can be stocked, or over which the ore can be dumped directly from the tramway into the railway cars. About 5,000 tons of the very best ore has thus far been taken from the shafts and drifts, and by the time the railway track reaches the mine there will be at least 10,000 tons in stock from which to commence the season's shipments. With no untoward circumstances intervening, the company's estimate of a product of 50,000 tons this year may be considered moderate rather than otherwise.

The location is a most beautiful one, and the lay of the ground most admirably adapted to mining purposes. The usual number of neat and substantial buildings have been erected, or are in course of erection, while near by is the new town of Iron Mountain City, at which point the mine branch connects with the main line of railway. As yet the new town consists of but few buildings, principally saloons, but it enjoys the advantage of the handsomest site on the range, and being on the main line of the railway, with the development of the new mines in the immediate vicinity bids fair to grow into a town of some importance.

THE STEPHENSON MINE

Is the property of the Lumbermen's Mining Co., and is located on the north-west quarter of the south-west quarter of section 4, town 39, range 29. It adjoins the Norway mine on the east, the Stephenson deposit being apparently an extension of the so-called north vein of the Norway, adjoining it on the south, and within a stone's throw of the engine house are the openings of the Saginaw, Sec. 4 mine, the ore in which is just as evidently a continuation of the south branch of the Norway deposit. The Stephenson vein, or deposit, dips to the south, and has an east and west trend, curving slightly to the north-west. The vein crosses the line between the Stephenson and Norway, at a point 120 feet north of the south-west corner of the tract on which the mine is situated, as described above, and crosses the Saginaw line at a point about 400 feet east of the same corner. Thus it will be seen that the company has about 400 feet of vein on the Stephenson tract, the average width of which is about 20 feet. The workings consist of two open pits in the west half of the vein, and two shafts—Nos. 3, and 4—the latter at the

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point where the vein crosses the line into the Saginaw, and No. 3 being 100 feet to the westward. Pit No. 2 is 100 feet west of No. 3 shaft, and 75 feet west of No. 2 is pit No. 1. Two test pits, not far apart, near the southeast corner of the tract, are both in ore, which is probably a part of the main vein or deposit. Operations were begun in August, 1879, but actual mining was not commenced until the following December. At present, work is being done in both the open pits, from which the principal part of the ore mined thus far has been taken. Both shafts are down to the first or 60-foot level, and connected by adrift, which last extends to the Saginaw line east of No. 4, and a considerable distance west of No. 3 The hoisting machinery consists of four 36-inch drums, made by Frazer & Chalmers, of Chicago, and is amply sufficient for the present requirements of the mine. The ore is a soft, blue specular, an average analysis of which afforded 58.90 per cent of metallic iron. Shipments will commence this spring from a goodly amount of ore in stock—a fair estimate of the probable output of the mine for the year being 40,000 gross tons. Railroad facilities are supplied by an extension of the Norway branch track, there being no necessity for tramways or inclines, since during the shipping season the ore can be dumped directly from the skips or buckets into the railway cars. The mine cannot be considered a large one, since the dip being to the south, it will not be many years before all the ore will be worked out down to the Saginaw line. There is enough of it, however, to afford reasonable encouragemet to the hope of a large return on the amount of capital invested.

The Lumbermen's Mining Co., which is the owner of other and more promising properties on the range, was organized in August, 1879, with a capital stock of $100,000—a fact which indicates a determination on the part of the corporators to indulge in nothing save legitimate mining enterprises. Its officers are:

President—H. Ludington, Milwaukee.

Vice-President—S. M. Stephenson, Menominee.

Treasurer — Isaac Stephenson, Marinette.

Secretary—Joseph Fleshiem, Menominee.

The Stephenson mine is in charge of Capt. John Carmichael, an old and experienced miner, and the work thus far accomplished would seem to indicate that the company has been most fortunate in the selection of a superintendent.

SAGINAW SECTION 4 MINE

Is located on the southwest quarter of the southwest quarter of section 4, town 39, range 29, and like the Stephenson, immediately adjoining the Norway on the east. It is the property of the Saginaw Mining Co., under a lease from the Hamilton-Merryman company, owners of the fee, by whom the first work was

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done in the winter of 1878-9, the first shipments being made in the following spring, the output for 1879 being 13,465 gross tons. The Saginaw deposit partakes more of the character of a well defined vein than any other the writer has yet seen on the range, and is undoubtedly continuous with the south branch of the Norway, which has been opened, and is being wrought close up to the line between the two properties.—the Saginaw openings being also near the line, and in the northwest corner of the40 acre tract. The vein has been opened in an open cut over a length of 350 feet, and to a depth of, perhaps. 60 feet. The width of the vein or deposit is such as to render it an easy task to support the walls with timbers, if necessary, though the ore being much harder than that at the other mines, it is perhaps cheaper to leave pillars, as is being done. The ore is of the same general variety so far characteristic of the range, though more compact, and partaking more of the character of the hard ores of the Marquette range. An occasional horse of rock is encountered in the west end, and a thin stratum of rock and mixed ore runs through the vein for a considerable distance to the east, where it disappears into the hanging wall. In the east end of the open cut a shaft has been sunk 3? feet below the bottom, all the way in ore. At the time of the writer's visit, a drift was being carried eastward 150 feet on the vein from the bottom of the open cut, to connect with a shaft which will be sunk that distance from the present east end of the mine. The vein, or deposit, which will thus be opened up over a length of 600 feet, is known to extend still farther eastward, thus making up, to a great extent, in length what it lacks in with. Four derricks are employed in hoisting the ore to the surface, two of which are operated by horse power and two by steam. There are two 30-inch hoisting drums, operating as many derricks, another of which, together with an additional derrick will be added at an early day, if indeed they are not already in place. The mine gives employment to about 75 men, and the ore taken out during the winter embraces from 12,000 to 15,000 tons. A fair estimate of the output the present year, would be 35,000 to 40,000 gross tons.

Capt. John Perkins is mining superintendent, and the appearance of the mine affords ample proof of his skill and practical ability as a miner.

THE CURRY MINE

Is located on the west half of the north-east quarter of section 9, town 39, range 29, only a short distance west of the most westerly openings of the Vulcan. The tract is held under a lease from the Canal Co. issued to Solomon S. Curry, March 6th, 1879, by whom it was transferred to the Curry Iron Co., which executed and filed articles of incorporation on the 15th of May the same year. In the following August Messrs. Curry

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and Swift, who were the owners of three-fourths of the stock; sold out their entire interest to J. H. Outhwaite, Esq., of Cleveland, Ohio, that gentleman being at the time the owner of the greater part of the other quarter interest. The officers of the company are:

President—John Outhwaite.

Secretary and Treasurer—J. H Outhwaite.

Superintendent—Solomon S.Curry

The first shipments were made in July last, and aggregated 12,803 tons at the close of navigation in the fall. The ore at once acquired a high reputation and was much sought after by furnacemen, the sales being equal to the utmost limit of production. The ore averages from 63 to 66 per cent. of metallic iron and has never shown more than .011 of phosphorus, as determined by Chas. E. Wright, analytical chemist, as well as by consumers who used the ore last season.

The workings at the Curry at present consist of one large open pit and two shafts in the vein or deposit, which is no doubt continuous with the Vulcan on the east, and possibly with that of the Saginaw and Stephenson on the northwest. Work was first commenced on the south-west slope of the hill, which rises to the height of about 75 feet above the level of the railway. At this point an open cut was carried into the hill a distance of 180 feet, on a vein of ore varying in width from 10 to 16 feet, at which point a perpendicular shaft has been sunk from the top down to the first or 50-foot level. Just west of this shaft a heavy pillar of ore has been left as a support to the walls, which are very nearly perpendicular—a drift connecting the open cut with a shaft at the bottom. A drift has been driven from the bottom of the shaft some 30 feet east on the vein, which is covered with a heavy capping of rock for a distance of nearly 100 feet east, at which point the vein takes an abrupt turn to the north and north-west, resuming an east and west course a hundred feet farther on. Around this first curve the vein dips to the north-east, gradually changing to the south once more as it rounds the second curve to the east. At a point about 150 feet from the open cut, following the run of ore from the west and around the curve to the north, is the second shaft referred to, which is down about 50 feet, all the way in ore. At the point where the vein again takes a bend to the east, is the open pit from which the greater part of the ore thus far mined has been taken. At this point the deposit carries a width of nearly 50 feet, and there is, perhaps, facing to the east and to the south, two as handsome stopes of clean blue ore as can be found anywhere on the range. The ore is very similar in appearance to that of the Vulcan, and uniformly of as good a quality. So far the mine has been wrought without the aid of machinery, other than a couple of derricks and whims, operated by

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horse-power. A double incline tramway, on which the weight of a loaded car descending to the bottom draws an empty one up the incline, conveys the ore from the mine to a spurr track from the Vulcan mine branch, where it is dumped upon the stock-pile or through pockets directly into the cars for shipment. Shipments were begun this season from a stock-pile embracing about 10,000 tons, though the officers of the company are modest enough to estimate the product for the year at not more than 25,000 tons. Considering, however that only thirty-five men are regularly employed in and about the mine, that the company thus far has been at no expense for machinery, that a yoke of cattle and a horse or two do all the hoisting, the estimated product, not only as to quantity, but having reference as well to the profits certain to be realized, will compare favorably with the results likely to be achieved by any other mine on the range. Though a small mine, the Curry has large possibilities, even probabilities ahead of it, the extent of which cannot now be predicted with any degree of certainty. Very few, if any, of the mines on the range have produced more ore with the same amount of expenditure, in the same length of time. Altogether, the writer looks upon the Curry as a most valuable property, and will be disappointed if at the end of the season she does not show a larger product than the estimate given him by the officers of the company.

THE LUDINGTON MINE

Is the property of the Lumbermen's Mining company, and is located on the north half of the south-east quarter of section 25, town 40, range 31, and about a half or three-quarters of a mile west of the Chapin. The company owns the south half of the same section, on which is situated the company's buildings—superintendent's residence, boarding houses and tenements—the north half of the quarter section on which the mine is located being held under a lease from the Canal company. The buildings referred to strike the visitor as being far more substantial than those at most of the other mines on the range, giving indubitable evidence of a belief on the part of the company that it has in the Ludington a mine that is not likely to be exhausted in a long term of years. The deposit, where opened, lies at an altitude of nearly 100 feet above the railway level, and is most favorably located for being economically wrought. Explorations were commenced in a small vein carrying a width of from three to six feet of clean ore, but which at first did not give promise of the ultimate development of a mine of any considerable value. A shaft sunk to a depth of 50 feet, however, shows in the bottom 20 feet of clean, blue ore of exceptional fine quality, with neither foot nor hanging wall in sight. From the bottom of this shaft, the miners are now driving a drift to the east, and carrying up a stope behind it,

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and also drifting to the west, all the work being in ore. This drift to the west is designed to connect with No. 3 shaft, 125 feet distant, which is now down 175 feet, but located too far south to strike the vein. From its bottom, however, a cross-cut is being made to the north through mixed ore, and it is believed will strike the deposit at a convenient distance. This vein has been opened, on the outcrop, over a length of 75 feet, and doubtless will be found to extend a considerable distance both east and west from the present workings. It is nearly vertical, but about 100 feet north of shaft No. 2 a perpendicular shaft struck another and separate vein, 50 feet below the surface, which carries a width of from 5 to 10 feet, and dips to the south at an angle of about 55 degrees. This north vein, judging from the dip, doubtless makes a junction with and becomes a part of the other at no very considerable depth; and should this prove to be the case, all doubt as to the great extent and value of the deposit will have been entirely dispelled. This question will be settled by at once sinking No. 2 shaft to the second, or 100-foot level, and then cross-cutting from the bottom to the northward, unless the management becomes satisfied that the supposed junction occurs at a point above that level, which is scarcely probable. The foot wall of both veins is a soapstone, with a hanging of mixed ore and jasper.

Other promising explorations are being made by the company on the north-west quarter of the same section, in what is believed to be a part and parcel of the deposit already referred to. Should this supposition prove correct, it is not improbable that the run of ore extends entirely across the section, from south-east to north-west, on lands wholly owned by, or under lease to, the company. Such a contingency is not at all improbable, though the truth in that regard can only be demonstrated by actual work, extending, possibly, through a period of several years. All the work has been done under the direction of Capt. Williams, who took charge of the company's mines as general superintendent on the first of March last. Capt. William Trebilcock has immediate charge of the mine work, and seems to have been selected with due regard for his ability, being, as he is, a miner of many years experience. Capt. Williams was formerly in charge of the Norway mine, in connection with which the writer gave him all the "taffy," as he calls it, his well known modesty will endure without a blush.

The machinery in use at the Ludington consists of a 12x24 engine, designed to operate four 3-foot drums, of which, however, only two are at present being used. A number 5 Sturtevant fan supplies the shafts and drifts with pure air, thus obviating the necessity of expensive

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air shafts. Shipments will be made over a branch line three-quarters of a mile in length, the grading of which is now in progress, and which will be completed and the rails laid as soon as the Menominee River extension is finished to the point of junction. An elevated trestle work has been built from the mouth of No. 2 shaft, on a gentle incline, to the point where a shipping dock and pockets over the branch railway are being constructed—the outer end of this trestle being at least fifty feet above the level of the track, thus facilitating shipments in summer, and affording all the room necessary for the stocking of the winter product. At the time of the writer's visit to the mine about 6,000 tons of ore had been mined, and should the openings continue to improve, it is not improbable that a product of 25,000 or 30,000 tons may be reached the present year. The ore is apparently of the same character, in all respects, as that of the Chapin, analyses showing it to be all that can be desired as to the percentage of metallic iron, while at the same time it is remarkably free from injurious substances, especially phosphorus. About seventy-five men are employed in and about the mine, which number will be increased as fast as it can be done with advantage.

SECTION 9.

The Lumberman's Mining Co. are making some elaborate explorations on the south half of the north-west quarter of section 9, town 39, range 29, where two shafts have been sunk, three hundred feet distant from each other, with a fair prospect of developing something of value. The west shaft is down eighty feet, on a small vein of ore, which was 1½ thick at the outcrop, but is found to widen out to four feet at the bottom of the shaft. From the bottom of this shaft a drift has been driven east in ore, while a winze is being sunk from this drift to the second level, about ten feet east of the shaft. The ore seems to improve, both in quantity and quality, in both the drift and winze, giving encouragement to the belief that a good workable deposit will be found at no greater depth than the second level. The east shaft is down 85 feet, in mixed ore, from the bottom of which a cross cut strikes the ore within a distance of sixty feet, but at the time of the writer's visit its thickness at this point had not been determined, though the ore was of apparent good quality. A 25-horse power engine and two small drums are employed in hoisting the ore and rock from the shafts. South of these workings there are a number of outcrops, and various test-pits reveal the existence of small veins of ore, and it is the intention to thoroughly explore this ground with the aid of a diamond drill as soon as one can be obtained. Situated as this tract is, between the Curry and Cyclops, it is hardly probable that operations now in progress can fail to develop upon it a paying mine.

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THE KEEL RIDGE MINE

Is located on the south-east quarter of section 32, town 40, range 30, the Emmet Mining Co. being the owner, in fee, of an undivided one-third interest, and holding the other two-thirds under a lease. The officers of the company are:

President—Sam'l Kimberly.

Vice President—Geo. Boyce.

Secretary and Treasurer—R. Williams.

The property was originally explored and the ore found by John McKenna, Esq., who had associated with him John O'Callaghan and William McCartney, the three selling out their interest in that part of the section on which the Keel Ridge is located, in January, 1880, to the present owners. The lease under which the company is operating includes the whole of the south half of the section, though the mine is situated on the south-east quarter, of which last the company owns an undivided one-third. What might properly be considered active work was not commenced until the present owners and lessees took hold of the property, which was on the 9th of January last, since which time about 5,000 tons have been mined and stocked ready for shipment. The course of the formation is from south-east to north-west, and there are two distinct and separate veins, or deposits, in the narrowest of which, lying to the south, mine work has thus far been principally confined. This vein carries a width of from 15 to 18 feet of rich, blue ore, something similar to, but not as soft as the Quinnesec, being mined in large pieces, with very little waste or fine ore. The width of the north vein has not yet been fully determined, though a cross-cut shows 28 feet of clean ore without having reached the hanging wall. The ore is much harder than that of the south vein, and carries some lime. The ore carries from 64 to 69 per cent. of metallic iron, as shown by various analyses; or rather, it should be said the product can be graded up to that standard of purity by careful selection. It is proper to say, however, that the ore taken out thus far will fall far short of these figures, a fact that can readily be accounted for when it is considered that the owners and lessees, being furnace owners, are their own customers, and that no part of the product will be offered in the market. The stock-pile, therefore, embraces, together with the richer ores, all that is sufficiently high in metallic iron to pay the cost of mining, and the cost of transportation to the owners' furnaces in Ohio and Pennsylvania. The fact, therefore, that the stock-pile shows considerable ore below the standard of first class, is no reflection on the mine itself, which certainly contains no greater proportion of lean ores than most of the other mines on the range. The workings at present consist of two open pits, and three tunnels into the side of the

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hill, which last are intended to tap and afford an outlet for the ore of both veins. The west tunnel starts at an elevation of 40 feet above the side track, and the most easterly one is 30 feet lower. These are supplied with tram roads, connecting with trestle works and pockets sufficiently elevated above the siding to facilitate loading into the cars, and also affording ample room for the stocking of the winter product. The hoisting so far has been done with the aid of horse power only, and it is not probable that other machinery will be found necessary until all the ore shall have been worked out above the tunnel levels. The mine gives employment to about 250 men, under charge of M. Harrington, mining captain, who is an old and experienced miner. Railway facilities have been secured by the building of 3,400 feet of side track from the main line of the extension along the foot of the hill in which the mine is located, from the east end of which the pockets are reached by a Y track up and along the side of the hill. The buildings on the location, for the accommodation of the employes, are of a substantial character, and collectively constitute a village of no mean proportions. The product of the mine the present year, it is estimated, will reach 40,000 tons, though the writer has his doubts whether these figures can be realized. It is possible, however, that when connection is made with both deposits through the tunnels, of which there will be six in all, with a likelihood of still other openings being made at other points on the veins, which have been traced over a length of over 1,900 feet, the daily average product may be increased to correspond with the estimate given. The indications point to the development of a prolific mine, one that may, perhaps, take rank among the best on the range.

THE CORNELL MINE

Is located on the north-east quarter of section 20, town 40, range 30, and is the property of the Himrod Furnace Company, of Youngstown, Ohio. The vein is in the south side of a high bluff, overlooking Lake Antoine, one of the most beautiful of our inland lakes. It is on the so-called north belt of the Menominee range, two miles north, in an air line, from the Keel Ridge, and about three miles north-west of the village of Quinnesec. The outcrop occurs at an elevation of at least 100 feet above the lake, the vein or deposit where opened carrying a width of 35 to 40 feet. The ore was discovered by John R. Wood, Esq., in the fall of 1879, actual mining operations being commenced in the following January, since which time some 5,000 tons have been mined and stocked ready for shipment. At the time of the writer's visit the mine work was being carried on in an open cut, about 300 feet in length, and 40 feet wide. In the west end of this cut, on the south side, a shaft has been sunk to a depth of 50 feet,

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from the bottom of which a cross-cut has been carried 35 feet to the north, all the way in ore. In the east end the deposit seemed to be widening out, but near the centre of the open cut there appeared to be a horse of rock, the extent of which could not then be determined. Enough work has been done, however, on the whole, to prove conclusively that the deposit is one of great value, the ore being a fine blue, soft specular, of exceptional good quality. All the ore thus far mined has been carted to the stock pile, but the mine is being supplied with adequate hoisting machinery, consisting of a 14x24 engine, and two of Merritt's interior gear drums, 4 feet in diameter—all of which were on the ground, and being placed in position at the time of the writer's visit. These will be operated in connection with two steam derricks until such time as the enlargement and deepening of the mine necessitates the substitution of skip-roads. The product will be shipped over a branch line two miles in length—an extension of the Chapin mine side-track. As at the Keel Ridge, the pocket will be reached by a Y track up and along the side of the hill. The machinery, when put in operation, will do away with the use of carts, as the ore will then be trammed on a gently descending incline from the mine to the pockets only a few hundred feet distant The product of the mine this year will probably reach 20,000 tons, and may exceed that amount. J. R. Wood, Esq., an old and well known Lake Superior miner, is superintendent, assisted by his brother Joseph as mining captain.

WISCONSIN MINES.

The article descriptive of the Cornell mine completed the list of working properties on that part of the Menominee range embraced within the limits of the upper peninsula of Michigan. It is altogether probable that others will be added to the list during the present year, as it is scarcely possible that the explorations now in progress can fail, in some instances at least, to result in the development of new and valuable mines, none of which, however, can be expected to figure largely in the shipping list the present season. Indeed, explorations in some of the localities referred to have already revealed the existence of ore deposits of apparent large extent and great value. Notable among these is the so-called Woods mine, adjoining the Cornell on the east, the Breen Bros.' explorations just west of the Breen mine, the new find made by Jack Armstrong in town 42, range 33, where, it is claimed, he has at least 100,000 tons of first-class ore in sight, and some promising developments on the line between towns 41 and 42, range 28, just south of the Felch mountain. The writer has not deemed it essential to the purpose had in view at the begin-

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ning, nor indeed could he have spared the time had he so desired, to visit all these different points in detail, and he consequently makes this brief mention of them from hearsay only, although he believes his information in the premises to be altogether reliable. It is not improbable that the so-called Felch mountain range may, through developments yet to be made, assume a hitherto unlooked for importance; indeed, it seems quite probable that future work may demonstrate the fact that the mines so far opened, and which have already been described in these papers, are but the outposts, so to speak, of the greater though undeveloped ore fields lying to the north and west of them, in towns 41, 42 and 43, ranges 31, 32 and 33, and extending, possibly, still farther north and west.

Having disposed to the best of his ability of the mines on the Michigan side of the river, the writer finally made a visit of inspection to the Commonwealth and Florence mines, in Marinette county, Wisconsin, about 18 miles distant north-west from the village of Quinnesec. Taking these in the order of their age, by priority of discovery, he will first give his attention to the

COMMONWEALTH MINE,

Which is located on the south-west quarter of section 34, town 40 N., range 18 E., and which is the property of the Commonwealth Iron Co. The company owns a compact estate embracing the whole of sections 34, 33, 32, the south half of 31, and the north-west quarter of 28, 40–18, 331 acres in section 4, 160 acres in section 5, town 39–18, and 160 acres in section 13, 39–17. The officers of the company are:

President—Alex Nimick, Pittsburgh, Penn.

Vice President—George H. Ely, Cleveland, Ohio.

Secretary and Treasurer—William H. Harvey, Cleveland, Ohio.

Superintendent—James E. Tobin.

Iron ore was first discovered on lands now owned by the company, by Col. Chas. Whittlesey, of Cleveland, Ohio, in 1859, from whose minutes they were entered by H. B. Tuttle, Esq., in 1867. In 1875 Prof. Charles E. Wright, while engaged in making a geological survey, found a loose ledge of ore under the upturned roots of a fallen tree, on section 34, which fact he mentioned to H. D. Fisher, Esq., who in the following year sunk some test pits near the locality indicated, and found the solid ledge. When Mr. Fisher reported his discovery very few people were willing to credit his statement as to the apparent great extent of the deposit, but the work that has since been done on the property proves that he did not in the least exaggerate the simple truth, either in regard to the extent or quality of the ore. For some time after the value of the property had been demonstrated beyond all question, through the exploration pits and trenches dug by Mr. Fisher, no

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further work was done—at least not until after the speedy extension of the Menominee River railway west of the river became a reasonable certainty. Indeed, the matter of securing railway facilities was the point first to be considered and accomplished; to secure them, Mr. H. A. Tuttle, for some time the moving spirit in this new enterprise, brought to bear upon the Northwestern company all the influence he could possibly command, but it was not until after the Menominee Mining Co. secured the ownership and control of the mine now known as the Florence, and added its powerful influence—an influence backed by a reasonable certainty of a very large ore tonnage—that the railway company could be induced to make the desired extension of its line to the mines in question Work on this extension, which involves the laying of about 20 miles of track, was commenced last fall, and is now in progress, with a reasonable prospect of being completed on or before the middle of August.

Referring again to the Commonwealth as a mine, we find in Prof. Wright's report, made to the Wisconsin state geologist, and embodied in that officer's report to the Governor, an illustration which includes a geological section showing the character of the formation, as well as that of the original surface of ground and rocks. This survey and sketch was made in September, 1877, at which time but a small portion of the deposit had been uncovered—scarcely more than enough, in fact, to enable him to determine the width of the ore formations. The sketch in question shows that the formation dips slightly to the south, and shows three parallel veins or beds of ore, the upper one of which is 14 feet thick, under which is found 28 feet of banded ore, then 68 feet of ore of uniform good quality, between which and another bed of ore 40 feet in thickness occurs 10 feet of slate. These measurements, it will be remembered, were made nearly three years ago, since which time the ore formation has been uncovered its whole width and over a length of 310 feet. This work reveals the fact that the 10 feet of slate which overlies the 40 feet of ore on the foot wall, entirely disappears 20 feet to the east of the point where Mr. Wright made his measurements, and shows in the east end 108 feet of clean ore, independent of the 15 feet next to the hanging. These parallel veins or deposits have been traced by test-pitting and outcrops over half a mile west of the present workings, and the writer regards the deposit as being, to all appearances, one of the largest he has ever seen. At the time of his visit the work of stripping was still in progress, and every preparation was being made for the prosecution of active mining operations as soon as the completion of the railway extension to the mine shall afford an outlet for its product. A shaft was

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being sunk in the east end to a depth of 40 feet, for the double purpose of draining the mine and supplying water for the boilers. The mine work will be prosecuted in an open cut, in which, by first sinking to a proper depth, several very large working faces can be obtained. The machinery, which was all in place at the time, and has doubtless ere this been set in motion, consists of a 12x 18 engine, and four 4-foot drums, designed to operate as many derricks, though only three are being used at present. These derricks will give place to skip-roads which will be put in next winter, or sooner should they become a necessity. The mine is most favorably located on the summit of a high ridge, along the north base of which, at no great distance from the workings, is the branch railroad track from the main line of the extension. Above this branch track will be the usual trestlework, with the accompanying dock and pockets, and a double-track incline tramway over which the ore will be carried from the mine and dumped directly into the railway cars or stock-pile.

The Commonwealth ores are of the red specular variety, though not so hard as those of the Marquette range. From a number of analyses, made from average samples taken from every six inches across the veins, Mr. Wright forms the conclusion that the product, if mined with ordinary care, will carry an average of 65 per cent. of metallic iron. The ores are, however, rather high in phosphorus—too high, in fact, for Bessemer purposes; in all other respects they are equally as good as the best first-class ores of either range, some of which labor under the same disadvantage. Mr. Wright, who has given the matter much thought and study, argues that there will be a marked decrease in phosphorus when greater depth is attained and the miners get into the solid ledge, where the ores "are less exposed to the seeping in of water holding phosphoric acid in solution." In support of this theory, which we believe to be a correct one, he refers to the record of some of the Marquette mines, the surface ores of which were equally as high in phosphorus as those of the Commonwealth, but which, in sinking, have decreased to such an extent as to bring them nearly, if not quite, up to the standard of Bessemer ores.

The Commonwealth ore belt has an east and west trend, and has been traced from the present workings all the way through sections 33, 32 and 31, a distance of nearly four miles, on lands owned by the company. On the southeast quarter of 33 there is a large outcrop, on which, however, no work has yet been done. On the southwest quarter of 32, where there was an outcropping of hard granular ore, carrying sufficient magnetite to give it an appearance similar to the magnetic ores of

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the Champion mine, a shaft has been sunk to a depth of 68 feet, in a vein 12 feet thick, and from which about 500 tons of rich looking ore was raised. An analysis of this ore, made by Mr. Wright, gave 65 per cent. of metallic iron. Test pits 400 feet west of this shaft show the same kind of ore, and about the same distance north is found a soapstone ledge, showing the formation to be unusually broad at this point. A sample of ore taken from an outcrop on the southeast quarter of 31, with some collected by Mr. Wright, gave by analyses 64 per cent. metallic iron. Altogether, the Commonwealth company is the owner of a most magnificent estate, the value of which is not likely to be over-estimated. When it is considered that in addition to the unquestionably very large deposit now being opened on section 34, and which for the present will constitute the Commonwealth mine proper, the company owns a territory covering four miles of the ore belt, as is conclusively shown by the outcrops and explorations made, the grand results to be achieved in the future seem almost incalculable. In addition to this, the company's lands are all covered with a heavy growth of hardwood timber, and have the further advantage of an excellent soil. A village site has been platted on the southeast quarter of section 28, upon which a number of substantial business buildings and dwellings have already been erected, and which bids fair to become a town of no secondary importance, as compared with others on the range. Indeed, the full development of the company's magnificent mineral domain alone, were there no other points in its favor, will assure the rapid growth of the village, and make it the center of a large trade identified with and dependent upon the large mining, lumbering, and yet to be developed agricultural interests of the locality.

At the mine location the usual complement of buildings have been erected for the accommodation of the employes—mostly commodious, well-built and comfortable log structures. The working force, at the time of the writer's visit, numbered nearly, if not quite, 100, which number will be increased as fast as it can be done with advantage. Very little ore has been mined so far, and nothing more than putting the mine in good shape, for rapid and economical work will be done until the railway is completed to the mine, which will not be before the first of August. By that time, however, several thousand tons will necessarily have been taken from the shafts and cuts being made for the purpose of drainage and securing the necessary stopes. It is intended to have this preparatory work finished by the time the railway is completed to the mine, from which time forward a large daily product will be assured.

The writer has visited few mines with which he was better pleased, at

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the same stage of development, and he ventures the assertion that no new mine, anywhere, gives greater promise of future large production.

THE FLORENCE MINE

Is located on the north half of the south-east quarter, and the north-east quarter of section 20, town 40, N., range 18, E.—the present workings being on the first named description. It is the property of the Menominee Mining Co., which owns three-fourths of the fee, and holds the remaining one-fourth under a lease from H. D. Fisher, who receives a royalty of ten cents a ton on all the ore mined. The company owns, in the same relative connection with Mr. Fisher, other valuable adjoining lands, including the south half of the south east quarter of section 21, on which the now flourishing village of Florence is located.

Ore was originally discovered on the tract, and near the place where the mine is now being opened, by Mr. Fisher, in October, 1874. Sufficient work was done under his direction to prove almost conclusively the existence of a workable and, perhaps, extensive deposit in the near vicinity, though subsequent developments showed that his original explorations were too far south to reveal the real extent or character of the ore formation. Such was the opinion of Mr. Wright when he visited and examined the property in the fall of 1877, and the work since done proves his opinion to have been well taken. Subsequent to this time Mr. Fisher, acting most probably on Mr. Wright's suggestion, sunk a shaft at some distance north of the point where the ore was originally discovered with the most favorable results, and, as now appears, about midway between the foot and hanging walls of the deposit. It is due to Mr. Wright to say that at the time of making his report to the state geologist, of Wisconsin, he explicitly stated that sufficient work had not been "advantageously performed to warrant the expression of a decided opinion" as to the extent or value of the deposit. Very little, if any, of the ore belt had then been uncovered, and his examinations were necessarily confined to pits and a trench on what now appears to be the foot wall, and in which some lean ore had been found, but which cannot be said to be a part of the main deposit as revealed by subsequent developments. By reason of these facts, Mr. Wright's report, together with the sketch showing the character of the formation, is greatly at fault, as the writer feels certain that gentleman will readily and cheerfully admit when he again visits the location. His report, however, in view of the facts and circumstances under which it was made, does not in the least reflect on his honesty or ability as a geologist or mining expert, when taken into consideration with the further fact that he then and there expressed the opinion that the

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ore would be found immediately to the north.

The trend of the ore belt is from south-east to north-west, and the formation dips high to the north. At the point where it is now being opened it lies in the north side of a hill or bluff, from the summit of which a view of the surrounding country, for many miles in every direction, can be had. The highest point where the ore has been uncovered lies at an elevation of at least 100 feet above the level of the railway, the face of the ore bed conforming to the topography of the ground, the north or hanging wall side being depressed to such an extent as to form a natural stope from which many thousands of tons can be mined without other preparatory work than the removal of the drift. The foot wall is a graphitic slate, and the hanging a graphite quartz. At the time of the writer's visit the deposit had been uncovered 140 feet lengthwise of the formation, and 100 feet in width, and the removal of the drift farther to the west was still in progress. The ledge immediately under the drift is covered to a depth of three or four feet with fine, loose soft ore, which might probably be denominated a soft hematite, under which the hard ore is found. This fact has been demonstrated by the sinking of a shaft and shallow pits, at various points on the deposit, in all of which the hard ore has been encountered at a depth of from three to four feet. An examination of the uncovered portion of this ore belt, forced upon the writer the conclusion that the company has here a solid body of ore corresponding, at the very least, with the extent of the surface workings, which as has been stated cover an area 100x140 feet, and which was at the time being rapidly enlarged. Indeed, it is claimed, and the writer has no reason to doubt the assertion, that test-pits and other explorations show nearly, if not quite, the same width of ore along a distance of half a mile west of the opening under consideration. At all events, enough work has been done to prove, beyond the suspicion of a doubt, that the Menominee Co. has in the Florence one of the largest bodies of clean ore known to exist anywhere. Relative to the quality of the ore, and the rather large percentage of phosphorus it is known to carry, the suggestions offered in the preceding paper are applicable here. Nine analyses of samples taken from different parts of the deposit gave an average of 64.52 per cent. metallic iron, and .098 of phosphorus.

The mine is most advantageously situated for mining purposes; as stated, the position of the vein is such that an immense stope is secured by merely carrying in a cut through the surface on the hanging wall side, from which the ore rises abruptly to a hight of nearly 50 feet before reaching the foot wall.

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The bottom of this first level will be at least 50 feet above the railway, over which the usual pockets, and docks for storage of winter product, are being constructed. No machinery will be required for hoisting or pumping for some time to come, and a second level can be opened whenever desirable by simply carrying in a cut or tunnel from a point near the base of the hill, and yet high enough up to permit the ore when trammed out to be dumped directly into the cars. In this regard the Florence is more advantageously situated than any other mine on the range.

The village of Florence, which is handsomely located on the north shore of Fisher Lake—a beautiful sheet of water—though platted only a few months ago, has already grown into a town of considerable importance, and, as the terminus of the railway extension, will doubtless continue to grow until a new terminus is sought farther to the north or west. At the time of the writer's visit some twenty-five or thirty business buildings and dwellings had been erected, two substantial hotels were going up, and probably ere this the number of buildings has been more than doubled. A more beautiful site for a village cannot easily be found, nor are there any towns on the Menominee range which can boast more brilliant prospects for the future.

The writer will watch the future progress of the Florence, as well of as the Commonwealth, with more than ordinary interest, believing, as he does, that they are but the advance guard in the development of a new iron field the extent and importance of which will astonish the iron world.

VILLAGES.

In the course of his articles descriptive of the various mining properties on the range, the writer has referred somewhat briefly to all the villages, proper and prospective, with the exception of the new town of Norway, which at the time his first paper concerning the mines of which it is the centre was written, was scarcely deserving of recognition as a village *de facto*, although giving promise of rapid growth and future great importance as a trading centre. For that reason he preferred to withhold all mention of the new town, believing that what he might then write concerning it would be far from true by the time his series of articles were finished and ready to be sent out in pamphlet form. In the meantime, Norway, which four months ago was a mere hamlet, has grown to be if not the largest, certainly the most flourishing and important town on the range. The mines in its immediate vicinity will furnish nearly, if not quite, two-thirds of the entire output of the range the present year, while the prospects are that the number of mines upon which it depends for its future growth and prosperity, will

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be considerably increased before the end of the year. The town was platted by C. L. Wendel, Esq., late in the fall of 1879, the location being on the line of the Menominee River Railroad, some 20 miles from its junction with the Northwestern, the spot selected for the town being, perhaps, one of the most uninviting that could have been found. It was, however, the only location obtainable, hence its selection. Notwithstanding the natural disadvantage referred to, Mr. Wendel went to work with an energy of purpose that could not fail to accomplish grand results, and now has the satisfaction of seeing, where seven months ago the pine forest broke suddenly away into a cedar swamp, a town numbering, together with the adjacent mine locations, a population not much, if any, less than 3,000. The town has several comfortable, well kept hotels, a number of general dry goods, clothing, hardware, drug, feed and furniture stores, a good school, several churches, a public hall, a weekly newspaper, and, in fact, all the concomitants of a full-fledged town. Building still continues apace, and with the mines to back it the ascendancy of Norway over all the other towns on the range, east of the river, will be assured beyond the contingency of a doubt.

Just east of Norway the Lake Superior Ship Canal, Railway & Iron Co. has platted a village site known as Frederickton, but as yet little has been done in the way of building up a town. The site is a beautiful one, and with the exercise of a little enterprise, seasoned with a proper amount of liberality, Frederickton could be made a formidable rival of Norway. It is intimated that a well directed effort will be made this year to give the new town a start on the way to future prosperity—or, at least, to secure that recognition to which its natural advantages entitle it.

ESCANABA.

These papers would be altogether incomplete without a suitable recognition of Escanaba, the lake port from which all the ores of the range are shipped, except the comparatively small amount that is carried by rail to Wisconsin furnaces.

The village of Escanaba is beautifully located on a point which divides the waters of Green Bay from those of Little Bay de Noc—that portion of the latter which lies under the point, forming one of the finest harbors on the whole chain of lakes. The first settlement was made in 1863, at which time work was commenced on the peninsula division of the Chicago & Northwestern Railway. The town steadily grew in size and importance, until the panic of 1873, when business being at a standstill, the place appeared to have reached its maximum as a shipping port for iron ore. The development of the Menominee range has, however, rendered the outlook much

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more promising, since this is the natural outlet for the ore product of all this part of the peninsula, at least; and a firm belief is entertained by the citizens that no more advantageous route to the east can be found for the ores of the Marquette district than by way of Escanaba; the day is expected soon to arrive when the city shall be the depot for the vast trade of Minnesota and the new north-west.

The most prominent feature of the city is, of course, the harbor before alluded to, which requires no expenditure for dredging, and is capacious enough to hold the entire lake marine. The prospect from the docks, and from the hill at the west of the town, is beautiful. To the north the shores on either side of the bay converge gradually, and appear to meet about seven miles above the city, though in reality the land beyond the point circles away again, forming another beautiful land-locked bay. To the south, the eye passing over the end of the peninsula, meets only the blue horizon of Lake Michigan, unless the haze of mid-summer reflects above the bosom of the bay the hills of Washington and St. Martin's islands.

The first building was erected by Wells & Perry; John Hart and Job P. Dodge built the next two. The population in 1870 was about 3,000; at the present writing it is, probably, 5,000. The first hotel was opened by Ferd. Armstrong, in the building now known as the Ludington house, and which is now well kept by James Nicholls. The principal hotel, and one that has made a reputation for itself, is the Tilden house, which enjoys a most beautiful site in the lower part of the city fronting Green Bay, the present proprietors adding to the natural beauty of the grounds by well directed efforts to extend the hotel lawn entirely down to the beach. Besides the Tilden and Ludington there are other hotels in the city, principal among which are the Oliver, Escanaba and Central. The business interests, apart from the iron trade, which last is the fountain of the city's prosperity, is centered on Ludington street which, owing to the supineness of the village fathers, has not yet been paved, though that will be done this summer. Among the business houses the finest is that of S. Greenhoot, who last year built one of the finest dry goods stores on the peninsula. Others are building beautiful brick blocks, and Ludington street will soon be equal to any business thoroughfare north of Milwaukee. There are many well built residences in various parts of the city; the view from Michigan avenue, however, at tracting many to the bay shore. Escanaba became the county seat in 1865; the post office was established in 1864, with the present incumbent, E. P. Royce, as post master. The name was selected from the proximity of the Escanaba river, which will

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ever call up poetical memories from Longfellow's allusion in the legend of Hiawatha.

An appropriation has just been made for building a court house and county offices.

The harbor front, which extends along the whole northern shore of the city, is, during the summer months, a scene of bustling activity. The stranger who comes hither from the inland cities of this and other states where the business is transacted on the street alone, is disposed to think this a dull, listless town while he observes only the progress of trade among the merchants, as the absence of the farmers' wagons give a lonesome air to the thoroughfares. This impression is dispelled at once by a visit to the iron and merchandise docks, which display an activity not exceeded in any port on the lakes. These docks are: the merchandise, pig iron, Goodrich and Oliver docks; the No. 1 ore dock, built in 1872, the No. 2, built in 1864, and No. 3, the largest of all, built this spring—the whole having a frontage of more than a mile, and a storage capacity of 40,000 tons. The ore, brought here over the C. & N. W. R'y, is deposited in the docks which are elevated forty feet above the water, and by means of long chutes which convey the iron directly to the hold, a vessel of the largest capacity can be loaded in from one to three hours. These docks exceed in size and convenience for shipping purposes anything of the kind in the world.

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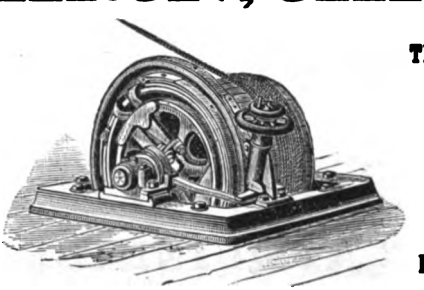

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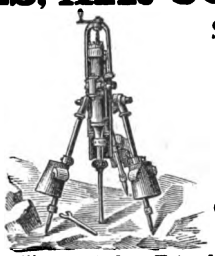

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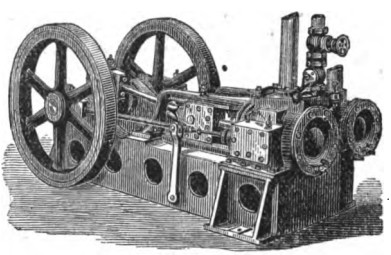

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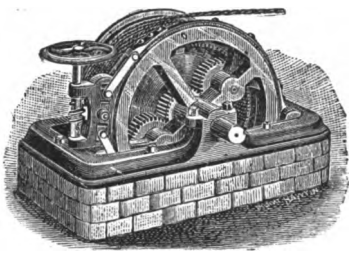

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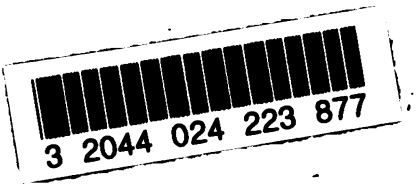

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